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# समाचार पत्रों से चयित अंश Newspapers Clippings

A Daily service to keep DRDO Fraternity abreast with DRDO Technologies, Defence Technologies, Defence Policies, International Relations and Science & Technology

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Fri, 01 Oct 2021

## **Rajnath Singh to review UP Defence Corridor Project in Lucknow next week; CM Adityanath to also attend**

*A defence ministry team will also travel to Lucknow along with Rajnath Singh to assess the project's progress and explore more possibilities of defence manufacturing in UP, two officials confirmed to News18*

*By Aman Sharma, Edited By Nitya Thirumalai*

The Defence Industrial Corridor Project in Uttar Pradesh will be comprehensively reviewed by Defence Minister Rajnath Singh in Lucknow on October 8 along with Uttar Pradesh Chief Minister Yogi Adityanath and top officials, News18 has learnt.

This comes after Prime Minister Narendra Modi had on September 14 observed the progress of the 'Aligarh Node' of the Defence Corridor during his visit. A defence ministry team will also travel to Lucknow along with Singh next week to assess the progress of the entire project and explore more possibilities of defence manufacturing in UP, two officials confirmed to News18.

The Centre and the Yogi Adityanath government are keen to fast-track this showcase project ahead of the Uttar Pradesh elections coming up in five months. The corridor has got a fillip since Brahmos Aerospace has proposed to set up a unit in Lucknow with Rs 300 crore investment to manufacture missiles. A missile manufacturing unit is proposed to be set up at Jhansi node too.

"The defence corridor project has become even more prestigious after Brahmos Aerospace decided to set up a missile manufacturing unit in the Lucknow node. This project has come with much push from Defence Minister Rajnath Singh, and UP CM Yogi Adityanath has fast-tracked allotment of land for it," an official said.

Over 90% of the land required for the Defence Corridor project in UP, around 1,480 hectares out of 1,639 hectares in all, has been acquired by the Uttar Pradesh government in the five nodes in Aligarh, Jhansi, Chitrakoot, Lucknow and Kanpur.

"More than one-and-a-half dozen defence manufacturing companies with investment worth billions of rupees will create thousands of jobs. New industries are being set up to manufacture small arms, armaments, drones and aerospace-related products, metal components, anti-drone systems etc in the Aligarh Node of the Defence Corridor. This will give a new identity to Aligarh and nearby areas," the PM had said in Aligarh.

Around Rs 9,000 crore are being invested in the next few years in Aligarh node of the Defence corridor, indicative of the huge investments and employment opportunities, the PM had said.



**Defence Minister Rajnath Singh speaks during unveiling of a statue of Mahant Avaidyanath in UP's Maharajganj, on September 24, 2021. (@rajnathsingh via PTI)**

## Progress So Far

Out of 1,480 hectares of land acquired so far for the Defence Corridor in UP, a total of 74 hectares has been allotted to 22 companies in Aligarh, Kanpur and Jhansi. The confirmed investment so far in Aligarh node is Rs 1245 crore. A total of 67, including 11 institutional MoUs, have been signed till date, estimating investments worth nearly Rs 9000 crore. Out of these, 19 MoUs have been realised bringing investment worth more than Rs 1000 crore. An MoU was signed with Bharat Dynamics Ltd this August for setting up defence corridor's first anchor unit in Jhansi for the manufacturing of propulsion systems.

Brahmos Aerospace, the joint venture of Defence Research and Development Organisation (DRDO) of India and NPO Mashinostroyeniya (NPOM) of Russia, has also proposed to set up the modern production facility in Lucknow with an investment of Rs 300 crore. It has assured to start civil construction within three months of getting possession of the land as it is slated to manufacture more than 100 Brahmos missiles in the next three years.

<https://www.news18.com/news/india/rajnath-singh-to-review-up-defence-corridor-project-in-lucknow-next-week-cm-adityanath-to-also-attend-4265411.html>



Fri, 01 Oct 2021

# रक्षा उत्पाद संबंधी एमएसएमई कार्यशाला का सकलेचा करेंगे शुभारंभ

By Shivani Rathore

इंदौर: जिला व्यापार एवं उद्योग केन्द्र इंदौर के महाप्रबंधक द्वारा बताया गया है कि मध्यप्रदेश शासन के सूक्ष्म, लघु एवं मध्यम उद्यम विभाग के मंत्री श्री ओमप्रकाश सकलेचा की अध्यक्षता में रक्षा उत्पाद, रक्षामंत्रालय, भारत सरकार द्वारा इंदौर जिले और आसपास के क्षेत्रों के उद्योगपतियों के लाभ हेतु एक दिवसीय कार्यशाला का आयोजन एक अक्टूबर 2021 को दोपहर ढाई बजे ब्रिलियंट कन्वेंशन सेंटर में किया जायेगा।

कार्यशाला में डीआरडीओ के सचिव डॉ. जी.सतीश रेड्डी द्वारा डीआरडीओ द्वारा विकसित तकनीकों पर आधारित उत्पादों के विकास एवं नवीन व्यवसाय के अवसर हेतु स्थानीय एमएसएमई इकाईयों के सहयोग एवं तकनीक का स्थानांतरण आदि विषयों पर उद्बोधन दिया जायेगा।

कार्यशाला में सूक्ष्म, लघु एवं मध्यम उद्यम इकाईयों की ऐसी इकाईयों को आमंत्रित किया गया है, जो उक्तानुसार वर्णित तकनीकों का लाभ प्राप्त कर भारतीय सेना को उत्पाद का विक्रय करना चाहती हैं और उद्बोधन सुनकर लाभ प्राप्त करना चाहती हैं। इस अवसर पर सचिव एवं उद्योग आयुक्त श्री पी. नरहरि एवं मध्यप्रदेश लघु उद्योग निगम, भोपाल के प्रबंध संचालक श्री व्ही गढ़पाले उपस्थित रहेंगे।

<https://ghamasan.com/msme-workshop-on-defense-products-to-be-organized-today/>

# All about Akash Prime Missile successfully test fired by DRDO: Range, speed, benefits to IAF & Indian Army

*An improved version of Akash missile currently used by the Indian Army and Airforce, Akash Prime has been launched by DRDO. Take a look at the details of the newer version developed by DRDO, Akash Prime missile currently test fired fro Odisha*

*By Tulika Tandon*

Defence Research and Development Organization, DRDO recently successfully test fired the newest version of Akash Surface to Air missile on September 27, 2021 around 4:30 pm. Akash Prime is a better version of Akash missile. The missile tests were performed from Chandipur test range in Odisha. It was its maiden flight test after the improvements suggested were made. In the maiden flight test the missile intercepted and destroyed an unarmed aerial target mimicking enemy aircraft.



Akash Prime Missile

DRDO released a statement which said, "In comparison to the existing Akash System, Akash Prime is equipped with an indigenous active Radio Frequency (RF) seeker for improved accuracy. Other improvements also ensure more reliable performance under low temperature environments at higher altitudes."

Defence Minister Rajnath Singh congratulated the DRDO, Indian Army, Indian Air Force, Defence Public Sector Undertaking (DPSU) and industry for the successful trials of Akash Prime Missile.

## **Akash Prime better version of Akash?**

The earlier version of Akash had an operational range of 27-30 km and the flight altitude of 18 km. This is similar in the Akash Prime as well. Indian Air Force and the Indian Army was asked about the review and feedback of the missile for the deployment of the system to provide air defence cover for vital high altitude regions in sensitive areas.

As per the official information, Akash Prime missile is equipped with indigenous active RF seeker which would give it an improved accuracy. It would also ensure that the target at which the missile is fired is hit by it.

Other improvements incorporated in Akash Prime include reliable performance under a low-temperature environment at higher altitudes.

The Akash SAM was developed to replace the Russian 2K12 Kub (SA-6 Gainful) missile system which happens to be currently in service. The Akash SAM, utilizes an integrated ramjet-rocket propulsion system like the Russian 2K12 Kub, which, after initial rocket motor burnout, provides sustained thrust for the missile throughout its flight until interception.

## **About Akash Missile:**

Akash is a surface to air medium range missile developed by DRDO and produced by Bharat Dynamics Limited. The missile has a target range of 50-80 km at altitudes of 18000 metres. It can neutralise fighter jets, cruise missiles and air to surface or ballistic missiles as well. It is used by the Indian army and air force.

The Indian Defence Minister Rajnath Singh congratulated the DRDO, Indian Army, Indian Air Force and other stakeholders on the successful trial of the Akash prime missile

<https://www.jagranjosh.com/general-knowledge/akash-prime-missile-successfully-test-fired-by-drdo-all-you-need-to-know-1632824871-1>

## Now, Ordnance Factory Medak under AVNL Chennai

Hyderabad: One of the biggest defence production establishments in Telangana and the only one in the country making armed combat vehicles, Ordnance Factory Medak, will be seen in a new role as it has been amalgamated into the newly-formed Armoured Vehicles Nigam Limited (AVNL) to be headquartered in Chennai (Avadi) from October 1.

All the 3,000-odd employees will be deputed and transferred into this new defence unit, one of the seven recently-formed after rejig of Ordnance Factories Board (OFB) headquartered at Kolkata, a few days ago. The Medak unit is among the 41 factories under OFB and its foundation stone was laid by the then Prime Minister Indira Gandhi and the first vehicle was rolled out in 1987 with technology assistance from Soviet Union and later the Russians, informed senior officials on Thursday.

Ever since for the last 37 years, it has been in the forefront in making armoured personnel carriers of various kinds with lot of indigenous technology inputs, including mine proof, bullet proof vehicles and those on reconnaissance missions and missile launch vehicles. OF-M has been collaborating with DRDO armament and combat engineering cluster like the Combat Vehicle Research Development Establishment at Chennai and the Vehicle Research Development Research Establishment at Ahmednagar.

Armoured Engineering Reconnaissance Vehicle with amphibious movement capabilities and another set to be able to detect biological, nuclear or chemical attacks are part of its production with the factory having the latest steel casting and aluminium foundry, heavy machining and assembly lines, precision cutting machines and castings.

Senior officials said high altitude and futuristic combat vehicles with night vision capabilities are being made following the recent border skirmishes with the Chinese. Till date, it is said to have rolled out more than 3,000 armoured vehicles with annual turnover of more than 100 with works on to double the capacity. Earlier this year, it has received the defence ministry order of about 150 combat vehicles.

The first ordnance factory was set up in Cossipore near Kolkata in 1801 and hence, the lineage can be traced to the British times but now the government wishes to make it easier for private sector participation under the public, private partnership for developing futuristic armoured vehicles in a more competitive manner, they added.

OF-M will now be part of three other firms in AVNL - Engine factory and heavy vehicle factory at Avadi, Machine Tool prototype factory at Ambernath (Maharashtra) and vehicle factory at Jabalpur (Madhya Pradesh).

<https://www.thehindu.com/news/cities/Hyderabad/now-ordnance-factory-medak-under-avn-chennai/article36761904.ece>

## Kamandag drills kick off in the Philippines with a focus on shore-based weapons

By Seth Robson

The use of shore-based weapons will figure prominently in an annual exercise involving U.S., Philippine and Japanese troops that kicked off in the Philippines this week, according to U.S. officials.

The start of Kamandag — short for “Kaagapay Ng Mga Mandirigma Ng Dagat,” or “Cooperation of Warriors of the Sea” — was announced by the U.S. Embassy in Manila in a Facebook post Thursday.

The exercise, which began in 2017 as a replacement for the large-scale PHIBLEX amphibious landing drill, was canceled last year because of the coronavirus pandemic.

This year’s scaled-down event will “focus on employing shore-based weapons, counterterrorism strategies, internal security operations, and humanitarian assistance and disaster relief efforts,” the embassy said in its message.

About 2,400 troops — 1,400 Americans, 900 Filipinos and 100 Japanese — were involved in last year’s drills.

Major Gen. Ariel Caculitan, commandant of the Philippine Marine Corps, said 242 Filipino marines will participate in this month’s eight-day exercise with 12 U.S. Marines and 25 Japanese troops, the Manila Bulletin reported Wednesday.

“We must be able to outmaneuver our enemies in the same way that we shall be able to maneuver this virus and still be able to continue to train, because we have a very big responsibility in terms of defense and security of our people,” Caculitan said during Kamandag’s opening ceremony at Fort Bonifacio in Taguig city, the newspaper reported.

A dozen Marines from the Okinawa-based 3rd Marine Division are on the island of Luzon training with Philippine personnel primarily focused on coastal defense and counter-landing operations., Maj. Kurt Stahl, a spokesman for the division, said in an email Thursday.

Training involving about 400 Marines that was scheduled for the Philippines was relocated Camp Fuji on mainland Japan and Okinawa due to the coronavirus pandemic, Stahl said.

“This training focused on moving to key maritime terrain, establishing coastal defenses, and practicing counter-landing operations,” he said.

One shore-based weapon the Philippines plans to purchase is the BrahMos supersonic cruise missile, developed by Russia and India. The country might also acquire Boeing’s Harpoon anti-ship missile, according to Ian Chong, an associate professor of political science at the National University of Singapore.

The BrahMos can be launched from air, land, sea and underwater and can carry conventional warheads weighing up to 660 pounds. It has a range of 180 miles and there is no known weapons system that can intercept it, according to BrahMos Aerospace.

“The Harpoon, first deployed in 1977, is an all-weather, over-the-horizon, anti-ship missile system,” Boeing states on its website. “It has a low-level, sea-skimming cruise trajectory with active radar guidance.”



Philippine marines observe their U.S. counterparts conduct a fire mission at Colonel Ernesto Ravina Air Base, Philippines, during exercise Kamandag in 2019. (Donald Holbert/U.S. Marine Corps)

The Harpoon weighs over 1,000 pounds and can fly up to 77 miles, according to its technical specifications.

Shore-based weapons may provide a means for the Philippines to defend maritime territory despite the clear limitations of the Philippine Air Force, Chong said in an email Thursday.

“That said, actually using these systems, especially with regard to gray-zone activities, could involve a degree of escalation that the Philippine government and its partners and allies wish to avoid,” he said.

Gray zone tactics are coercive activities that fall short of warfare. China has employed them against the Philippines in recent years. For example, it has illegally occupied territory claimed by the Philippines and sent a fleet of maritime militia to harass fishermen who enter disputed waters.

Both the Marine Corps and the Japan Ground Self-Defense Force have been exploring the use of ground troops to call in fire on ships off-shore, Chong said.

U.S. Marines, armed with High Mobility Artillery Rocket Systems, or HIMARS, and M777 towed howitzers were in Australia this summer honing sea denial and sea control skills from small expeditionary bases.

[https://www.stripes.com/theaters/asia\\_pacific/2021-09-30/kamandag-military-exercise-philippines-us-japan-3074930.html](https://www.stripes.com/theaters/asia_pacific/2021-09-30/kamandag-military-exercise-philippines-us-japan-3074930.html)



# Defence Strategic: National/International



Press Information Bureau  
Government of India

Ministry of Defence

Thu, 30 Sept 2021 4:25PM

## Air Chief Marshal VR Chaudhari takes over as the Chief of the Air Staff

Air Chief Marshal VR Chaudhari PVSM AVSM VM ADC took over as The Chief of the Air Staff (CAS) at a ceremony at Air Headquarters (Vayu Bhawan) today.

An alumnus of NDA, the CAS was commissioned in Dec 82 in the fighter stream of the IAF. He has flown more than 3800 hours on multiple fighter and trainer aircraft.

During his career spanning almost four decades, the CAS has tenanted many significant command and staff appointments. He has commanded a MiG-29 Squadron, two Air Force Stations and Western Air Command. His staff appointments include Deputy Chief of Air Staff, Senior Air Staff Officer at HQ Eastern Air Command, Assistant Chief of Air Staff Operations (Air Defence), Assistant Chief of Air Staff (Personnel Officers), Deputy Commandant of Air Force Academy and Air Assistant to Chief of the Air Staff.

A Cat 'A' Qualified Flying Instructor, he has served as an instructor at Flying Training Establishments and has also been an Air Force Examiner. He was a pioneer member of the Suryakiran Aerobatic Display Team. An alumnus of Defence Services Staff College, Wellington, he has served as a Directing Staff there. He has also served as Directing Staff at DSCSC in Zambia. Prior to assuming the present appointment, he was the Vice Chief of the Air Staff.

CAS is a recipient of Param Vishisht Seva Medal (PVSM), Ati Vishisht Seva Medal (AVSM), Vayu Sena Medal (VM) and is honorary ADC to the President of India.

In his address to the IAF, Air Chief Marshal VR Chaudhari said that he was honoured and privileged to have been entrusted with the responsibility of leading the Indian Air Force. Extending greetings to all Air Warriors, Non Combatants (Enrolled), DSC personnel, civilians and their families, CAS expressed absolute faith and confidence in their ability to accomplish all assigned tasks with resolute dedication while maintaining IAF's operational capability at an all-time high.

Outlining the focus areas for Commanders and personnel, CAS said, "Protection of our Nation's sovereignty and integrity is to be ensured at any cost". He added that enhancement of operational



capability through integration of newly inducted platforms, weapons and equipment with existing assets and dovetailing the same in concepts of operations would remain a priority area. He spoke on aspects of acquisition of new technology, promotion of indigenization and innovation, strengthening of cyber security, rapid adaptation of training methods to meet future demands and sustained work to nurture human resources. CAS urged all to "always uphold the ethos and credo of the 'Air Warrior', and strive to be an asset to the IAF in any role tasked for".

<https://pib.gov.in/PressReleasePage.aspx?PRID=1759645>

# अमर उजाला

Fri, 01 Oct 2021

## एयर चीफ मार्शल वीआर चौधरी बने भारतीय वायुसेना के नए प्रमुख, आरकेएस भदौरिया की ली जगह

सार

एयर चीफ मार्शल विवेक राम चौधरी ने एयर चीफ मार्शल आरकेएस भदौरिया की जगह ली है। भदौरिया 42 वर्षों तक वायुसेना में अपनी सेवा देने के बाद रिटायर हो रहे हैं।

विस्तार

नई दिल्ली: चीन के साथ चल रहे सीमा विवाद के समय लद्दाख सेक्टर के प्रमुख रहे पूर्व लड़ाकू विमान पायलट एयर चीफ मार्शल विवेक राम चौधरी ने नए वायुसेना प्रमुख के रूप में पद संभाल लिया है। इस पद पर उन्होंने एयर चीफ मार्शल आरकेएस भदौरिया की जगह ली है। भदौरिया 42 वर्षों तक वायुसेना में अपनी सेवा देने के बाद रिटायर हो रहे हैं। उनके कार्यकाल में ही भारतीय वायुसेना ने 36 राफेल और 83 स्वदेशी तेजस मार्क-ए लड़ाकू विमानों की दो बड़ी डील की थी।



एयर चीफ मार्शल विवेक राम चौधरी ने इस पद पर एयर चीफ मार्शल आरकेएस भदौरिया की जगह ली है। - फोटो : ANI

रहेंगी कई जिम्मेदारियां

नए वायुसेना प्रमुख विवेक राम चौधरी ने बॉर्डर और वायुसेना के हेडक्वार्टर में दोनों जगहों पर अपनी सेवाएं दी हैं। वह ऐसे समय में वायुसेना की कमान संभाल रहे हैं जब भारत का चीन के साथ सीमा विवाद और पड़ोसी देश अफ़गानिस्तान में भी उथल-पुथल का दौर जारी है। उनपर भविष्य में रूस से लिए जाने वाले एस-400 प्रणाली के संचालन और आगे जाकर वायुसेना के बेड़े में शामिल होने वाले नए स्वदेशी और विदेशी विमानों की भी जिम्मेदारी रहेगी।

करगिल के समय भी दी सेवाएं

उन्होंने पाकिस्तान के खिलाफ ऑपरेशन मेघदूत (सियाचिन अभियान) और ऑपरेशन सफेद सागर (1999 में करगिल में सहायता) जैसे मौकों पर भी वायुसेना में अपनी सेवाएं दी हैं। चौधरी ने ही पश्चिमी कमान का प्रमुख रहते हुए राफेल विमानों के बेड़े को अंबाला एयरबेस पर इंडकट कराया था और उनके बेटे भी राफेल लड़ाकू विमान के पायलट हैं। चौधरी 1982 में वायुसेना के लड़ाकू बेड़े में भर्ती हुए थे और अपने कार्यकाल में उन्होंने 38000 घंटों से ज्यादा विभिन्न तरह के विमानों को उड़ाया है।

कई प्रमुख पदों की संभाली कमान

विवेक राम चौधरी ने नेशनल डिफेंस एकेडमी (एनडीए) और डिफेंस सर्विसेज स्टाफ कॉलेज(वेलिंगटन) से अपनी पढ़ाई की है। उन्होंने अपने कार्यकाल में एक फ्रंटलाइन बेड़े और एक एयरबेस के प्रमुख का पद संभाला है। चौधरी ने इसके अलावा एयर फोर्स एकेडमी के डिप्टी कमांडेंट, एयर स्टाफ ऑपरेशन(एयर डिफेंस) के असिस्टेंट चीफ और एयर स्टाफ (पर्सनल ऑफिसर्स ) के पदों पर भी अपनी सेवाएं दी हैं।

<https://www.amarujala.com/india-news/air-chief-marshall-vivek-ram-chaudhary-takes-charge-from-r-k-s-bhadauria-as-the-new-indian-air-force-chief>

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Fri, 01 Oct 2021

## ‘Free and open Indo-Pacific’: CDS Rawat meets US General Milley, both sides agree to increase interoperability between forces

*Chief of Defence Staff General Bipin Rawat on Thursday met his US counterpart, General Mark Milley*

### **Key Highlights**

- **Chief of Defence Staff General Bipin Rawat met his US counterpart General Mark Milley**
- **The two officers discussed a range of issues, including ways to ensure regional security**
- **US, and India share a strong military-to-military relationship under the US-India Major Defense Partnership, which supports a free and open Indo-Pacific**

New Delhi: Chief of Defence Staff General Bipin Rawat met his US counterpart General Mark Milley and the two officers discussed a range of issues, including ways to ensure regional security and their respective roles as principal military advisors to civilian leadership.

Issuing a statement at this high-level meeting, the US Department of Defense said that the US and India share a strong military-to-military relationship under the US-India Major Defense Partnership, which supports a free and open Indo-Pacific.

The two leaders agreed to continued cooperation in training exercises and creating more opportunities to increase interoperability between the two forces, Joint Staff Spokesperson Col. Dave Butler said.

The meeting took place in the Pentagon.

**‘Your leadership will certainly play an important role in how this decade is shaped’**

This meeting comes days after Prime Minister Narendra Modi met US President Joe Biden in the United States during which the two leaders agreed to build on their strong partnership.

“We are meeting at the start of the third decade of this century. Your leadership will certainly play an important role in how this decade is shaped. The seeds have been sown for an even stronger friendship between India and the USA,” the Prime Minister had said.



US service members conducted an Armed Forces Full Honor Arrival Ceremony and an Armed Forces Full Honor Wreath Ceremony in honor of Gen. Bipin Rawat, Chief of Defence Staff | Photo Credit: Twitter

## ‘Relations between India and the US destined to be stronger’

Responding to this, Biden said that relations between India and the US are destined to be stronger.

“We should explore what more can be done to combat COVID-19, climate challenge and work for a safer Indo-pacific,” he said.

Since 2016, India and the US have signed four major defence enabling agreements.

In July, under US-India Defence Technology and Trade Initiative (DTTI), the United States and India agreed to a USD 22 million project to co-develop air-launched unmanned aerial vehicles.

DTTI currently encompasses four working groups, and the next senior officials' meeting later this year would further expand defence industrial collaboration, PTI said quoting the White House fact sheet.

<https://www.timesnownews.com/india/article/free-and-open-indo-pacific-cds-rawat-meets-us-general-milley-both-sides-agree-to-increase-interoperability-between-forces/818887>



Fri, 01 Oct 2021

# Border incidents with China will continue till boundary agreement is reached, says Indian Army Chief

*Referring to Afghanistan, the army chief said the Indian Army "or the armed forces for that matter continue to carry out periodic evaluation of threat perceptions"*

New Delhi: Border incidents between India and China will continue to occur till a boundary agreement is reached between the two countries, Army Chief General M M Naravane said on Thursday.

Recent developments in Afghanistan “have definitely been the focus” of the Indian Army that continues to evaluate threat perceptions and formulate strategies accordingly, the Army chief added while addressing a gathering at the PHD Chamber of Commerce and Industry.

Discussing China, he said, “... we have an outstanding border issue. We are again well prepared to meet any misadventure that may occur as we have demonstrated in the past.”

“Such kinds of incidents will continue to occur till such time that a long-term solution is reached, and that is to have a boundary agreement. And that should be the thrust of our efforts so that we have lasting peace along the northern (China) border,” he stated during the annual session meeting of the industry body.

Referring to Afghanistan, he said the Indian Army “or the armed forces for that matter continue to carry out periodic evaluation of threat perceptions”.

Based on those evaluations, the Indian Army formulates strategies and doctrines that are needed to meet future threats, he noted.

“This is a continuous process that never stops,” he added.

Kabul fell to the Taliban on August 15. Expressing its concerns about the Taliban takeover of Afghanistan, India had on September 20 had said the country’s territory should not be used for sheltering, training, planning or financing terrorist acts.



File photo of Indian Army Chief General M M Naravane (Express Photo by Ashish Kale)

As far as the terrorist threat is concerned, the Indian Army is ready to meet all challenges, Naravane said.

“We have a very dynamic counterinsurgency and counterterrorist grid in Jammu and Kashmir. It is a dynamic grid and it is based on threat perception and the escalating levels of attempts by our western neighbour (Pakistan) to push in more and more terrorists,” he said.

Based on ups and downs, we also recalibrate our levels of operations, he added.

The current border standoff between the Indian and Chinese armies erupted in May last year following a violent clash in the Pangong lake area. Both sides gradually enhanced their deployment by rushing in tens of thousands of soldiers as well as heavy weaponry.

The row escalated after the Galwan Valley clashes on June 15 last year. Twenty Indian Army personnel laid down their lives in the clashes that marked the most serious military conflicts between the two sides in decades.

In February 2021, China officially acknowledged that five Chinese military officers and soldiers were killed in the clashes with the Indian Army though it is widely believed that the death toll was higher.

As a result of a series of military and diplomatic talks, the two sides completed the disengagement process in Gogra area last month.

In February, the two sides completed the withdrawal of troops and weapons from the north and south banks of the Pangong lake in line with an agreement on disengagement.

Each side currently has around 50,000 to 60,000 troops along the LAC (Line of Actual Control) in the sensitive sector.

In 2017, Indian and Chinese troops were engaged in a 73-day stand-off in Doklam tri-junction which even triggered fears of a war between the two nuclear-armed neighbours.

The India-China border dispute covers the 3,488-km-long LAC. China claims Arunachal Pradesh as part of southern Tibet while India contests it.

<https://indianexpress.com/article/india/india-china-border-issue-lac-afghanistan-7543722/>

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*Fri, 01 Oct 2021*

## **Army, Navy & Air Force have their own challenges due to proxy war in J&K: Gen MM Naravane**

*Indian Army Chief Gen MM Naravane said at an event in Delhi that the Army, Navy and Air Force face different challenges due to the proxy war in Jammu & Kashmir*

*By Aayush Anandan*

Indian Army chief General MM Naravane said at an event in Delhi that the Indian Army, Navy and Air Force face different challenges due to the peculiar environment of contested challenges and the ongoing proxy war in Jammu and Kashmir.

He asserted that the Indian Army is focused on safeguarding the territorial integrity and sovereignty of India throughout the year and said, “Maintaining high levels of readiness and operation preparedness to meet all contingencies is part of Army's culture. COVID underscored timelessness of many fundamental principles that lay in the foundation for resilient structures and processes.”

Naravane talked about the Indian Army's support to the Indian Defence Industry to supply the latest technology and said, “Indian Army is fully committed to promoting Indian Defence Industry.

Our MSMEs need to reinvent and engage themselves in niche domains, build capabilities for precision parts and offer innovative solutions in disruptive technologies.”

Earlier on Tuesday, Union Defence Minister Rajnath Singh had said that the Indian Defence Industry must utilise the new policy reforms initiated by the government over the past few years and focus on boosting domestic defence manufacturing.

### **Reforms by the government to support domestic manufacturing of arms**

Last year in August, the Ministry of Defence had released a statement announcing that India will no longer import 101 different types of weapons and military platforms like transport aircraft, light combat helicopters, conventional submarines, cruise missiles and sonar systems. The transition will be completed by 2024.

In another list of excluded items, the Ministry put import restrictions on 108 military weapons and systems such as next-generation corvettes, airborne early warning systems, tank engines and radars, was issued recently.

Earlier in May 2020, the government announced that they would be increasing the FDI limit from 49% to 74% under the automatic route in the defence sector. The present government has put emphasis on reducing the dependence of the armed forces on imported military platforms and has decided to support domestic defence manufacturing.

The defence ministry has also set a target of Rs 1.75 lakh crore in defence manufacturing by 2025 that includes an export target of Rs 35,000 crore worth of military hardware.

<https://www.republicworld.com/india-news/general-news/army-navy-and-air-force-have-their-own-challenges-due-to-proxy-war-in-j-and-k-gen-mm-naravane.html>



Image: ANI

## ThePrint

Fri, 01 Oct 2021

# For future wars, World War 2 Army divisions won't cut it. It's time for a 'revolution'

*Integrated battle groups have helped the Army optimise its size and make itself more agile. Now it's time to boost our national security with reforms*

*By Lt Gen H S Panag (ret'd), Edited by Srinjoy Dey*

Three years ago, the Indian Army carried out four studies to bring about a “revolution in Indian Military Affairs,” — an all-encompassing military hypothesis about future warfare based on new theories of victory and emerging military technologies. The research necessitated changes in strategy and restructuring/reorganisation of the armed forces to enable them to fight wars of the future.

The first study focussed on restructuring, reorganisation and right-sizing of the field formations to make them more agile and responsive, and improve the tooth to tail ratio. The second was on the re-organisation of the Army headquarters to bring in integration and preclude redundancies. The third was to carry out a review of the officers’



Representational Image | Indian Army soldiers patrolling the Line of Control in Poonch district, Jammu and Kashmir | File photo: ANI

cadre to meet their aspirations. The fourth reviewed the terms of engagement of rank and file and was aimed at harnessing the higher life expectancy and ensuring a younger profile of key commands and motivation of the personnel.

The recommendations of the four studies were approved during the Army Commander's conference on 9 October 2018. The implementation of the recommendations has been a work in progress. These reforms started without a strategic review and a formal national security strategy and fell well short of the lofty goal of bringing about a revolution in military affairs (RMA). The reforms were not government-owned and did not take into account the budget, which is contingent on the technological transformation and modernisation necessary for optimising the size of the Army. The premise was probably to get on with restructuring and reorganisation and progressively introduce high-end technology.

Be that as it may, the pathbreaking reform to restructure and reorganise the field formations has been pursued with zeal and resolve. I analyse the progress of this reform to create Integrated Battle Groups (IBGs) as the basic fighting formation for the future.

### **Default fighting formation for the Army**

The "division," in various forms, has been the default combined arms fighting formation capable of independent operations for over two centuries. Three to four divisions are grouped under a Corps. Its strength varies from 10,000 to 20,000 personnel, with three to four manoeuvre brigades supported by combat /logistic support formations/units under centralised control. A division could field three/four brigade-size combined arms groups for operations. The last major wars fought with this size formation were the first and second Gulf Wars.

Over the last two decades, most nations concluded that the probability of full-scale wars to achieve decisive victories is very low. Future conflicts, particularly between nations armed with nuclear weapons, will be limited in time and space and dominated by high-end precision and lethal military technology. The first mover will have a major advantage. In such wars, the Corps and divisions were too unwieldy and slow to respond. This led to the evolution of tailor-made combined arms battle groups of brigade-size operating directly under the Corps. Modern communications and networking overcome the need for a division.

A classic example of their employment was the preemptive People's Liberation Army operations at multiple points in Eastern Ladakh last year, employing only six Combined Arms Brigades.

In a nutshell, the division had centralised resources and allocated them to create brigade-sized battle groups. Now the combined brigade size battle groups ab initio are tailor-made keeping in view the threat, terrain and mission with varying fighting units — armoured, mechanised infantry and infantry, and combat/logistics support units/subunits. All modern armies have transformed or are in the process of making such a grouping as the default fighting formation. The Indian Army has named its new default fighting formation as the Integrated Battle Group (IBG).

### **Integrated Battle Groups**

It is heartening to note that the Indian Army has been very methodical in evolving, refining and testing the concept of IBGs over the last three years and has now reached the execution phase.

All IBGs will be tailor-made keeping in view the mission, threat and terrain. The divisions will be transformed into two or three IBGs commanded by Brig/Maj Gen operating directly under the Corps HQ. The IBGs will have command and control and organisational flexibility for interoperability with enhanced or reduced resources. The IBGs can be mechanised forces or infantry predominant or balanced, depending on the role. The quantum of combat support and logistics support units/subunits can also vary. The Corps will directly control the long-range and bigger combat/logistics support formations/units. A corps may have six to nine IBGs depending upon its role.

This restructuring and reorganisation will optimise the size of the army to save manpower and make it more agile. IBGs will be able to execute the Cold Start strategy more efficiently. Conversely, these can be rapidly deployed to deny or even preempt an enemy attempting

preemption. Based on its surveillance and reconnaissance in Eastern Ladakh, a restructured 14 Corps with three to four IBGs could have preempted the PLA by securing the un-held Depsang Plains, Gogra-Hot Springs-Kongka La, north of Pangong Tso and the Kailash Range both in Chushul and the Indus Valley sectors or even across the Line of Actual Control. The void in 14 Corps could have been filled by reserve formations moved from the plains.

Two IBGs, one each in 9 Corps (in the plains) and one in 17 Corps for high altitude, are likely to be in place by the end of September. In phase one, probably by mid-2022, the divisions of 17, 9 and 33 Corps will be converted into two, four and six IBGs respectively. Thereafter, progressively, all divisions will be restructured/reorganised as IBGs.

### **The missing link**

The Army has done well to begin this path-breaking, in-house reform to restructure/reorganise the World War II vintage fighting formations. General Bipin Rawat, who was the initiator of this reform, is now the Chief of Defence Staff. He must now prevail upon the Narendra Modi government to own and formalise the RMA.

After a strategic review, the national security strategy must be formalised. The reforms to bring about the RMA must be tri-service, all-encompassing, including the creation of theatre commands, and guided by a steering committee under the defence minister. The process must be progressive and related to the defence budget our economy can sustain. The RMA requires political will and holistic and radical reforms. Incremental changes, however good, will invariably fall well short of this ideal.

*(Lt Gen H S Panag PVSM, AVSM (R) served in the Indian Army for 40 years. He was GOC in C Northern Command and Central Command. Post-retirement, he was Member of Armed Forces Tribunal. Views are personal.)*

<https://theprint.in/opinion/for-future-wars-world-war-2-army-divisions-wont-cut-it-its-time-for-a-revolution/742841/>

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*Fri, 01 Oct 2021*

## **'AUSINDEX': India, Australia participate in 4th edition of biennial maritime series**

*Indian Navy and Australian Navy on Thursday, September 30 participated in the fourth iteration of the biennial maritime series 'AUSINDEX'*

*By Apoorva Kaul*

India and Australia on Thursday, September 30 participated in the fourth iteration of the biennial maritime series 'AUSINDEX'. According to ANI, the exercise will allow the Australian Navy and Indian Navy to strengthen "inter-operability, gain from best practices". The exercise will also develop a 'common understanding of procedures for maritime security operations'. The maritime exercise are conducted in India and Australia, with recent being conducted in the Northern Australia Exercise Area.



**Image: Twitter/@CN\_Australia**

Taking to Twitter, Chief of Navy Australia Michael Noonan called the maritime exercise an opportunity to showcase the ability to conduct 'high-end maritime warfare training' with India. Furthermore, he informed that the exercise showcases a range of Australian Navy maritime capabilities. In the video shared on Twitter by Michael Noonan, Lieutenant Commander Stephen Wall, Principle Warfare Officer - HMAS Warramunga informed that the 'AUSINDEX' is a biennial exercise that is



conducted between the Australian Navy and the Indian Navy. The maritime exercise is conducted in Australia and India, with the recent one being held in the Northern Australia Exercise Area.

Furthermore, Wall in the video mentioned that exercise is composed of individual serials and vignettes that showcase all the challenges involved in modern maritime operations. According to ANI, the bilateral maritime exercise began in 2015 and over the years 'AUSINDEX' has grown in complexity. The third edition of the exercise was conducted in the Bay of Bengal in 2015. The exercises that were held in the Bay of Bengal included anti-submarine drills for the first time. In the fourth edition of AUSINDEX, surface units of both countries will be included. They will be exercising with HMAS Rankin, Royal Australian Air Force P-8A and F-18 aircraft, a Collins Class Australian Submarine and integral helicopters of Australian and Indian Navy.

<https://www.republicworld.com/world-news/rest-of-the-world-news/ausindex-india-australia-participate-in-4th-edition-of-biennial-maritime-series.html>



Fri, 01 Oct 2021

## **New drones, jets, electronic warfare fighter and more: China displays military might at Airshow**

*Airshow China began on Tuesday in the city of Zhuhai, displaying China's air force might.*

*However, foreign observers kept a close eye on developments from afar.*

Zhuhai (China) | Reuters: China put on an extravagant display of once-secret high-end military technology at its largest air show this week, while broadcasting its growing ambitions in space exploration and for self-sufficiency in commercial aircraft.

Pandemic-related travel restrictions meant Airshow China in the southern city of Zhuhai was a largely domestic affair, but foreign observers kept a close eye on developments from afar as China builds its military strength.

"Key platforms in service with the PLAAF – having been operated in tight secrecy previously – being shown to the public for the first time have attracted considerable attention from the international audience," said Kelvin Wong, a Singapore-based defence editor at Janes.

He pointed to WZ-7 Xianglong, a high-altitude long-endurance reconnaissance drone roughly analogous to the US-made Northrop Grumman (NOC.N) RQ-4 Global Hawk but with inferior engines. The WZ-7 has been sighted operating out of airbases close to the Sino-Indian border, the North Korean border and the South China Sea, Wong said.

China has been working hard to improve the performance of its homegrown engines, which have lagged Western technology. At the show, it flew its J-20 fighter jets with Chinese engines rather than Russian ones for the first time.

Testing is also underway for two types of domestic engines for its Y-20 transport plane, the plane's chief designer told the Global Times on Wednesday.

The J-16D electronic warfare fighter, its closest equivalent to the U.S.-made EA-18G Growler, was on ground display, showcasing a capability that experts say could help it erode Taiwan's anti-aircraft defences in the event of a conflict.

Wong said at least three types of jamming pods were hung on the plane, suggesting that each was designed to disrupt different parts of the electronic spectrum.



Image Credit: Reuters

China also revealed it is pursuing a "loyal wingman" drone to help protect pricier crewed fighter jets, in line with rival projects in the United States, Britain, Australia, India and Russia.

The developer did not say whether that drone, the Feihong FH-97 concept, would be exported, but the presentation was attended by many foreign observers.

### **The next frontiers**

China also revealed it expected to launch its next generation of heavy-duty rockets, powerful enough to send a crewed spacecraft to the moon, in 2028 - two years earlier than previously expected.

In commercial aircraft, China is stepping up efforts to become more self-sufficient in key technologies amid trade tensions with the United States.

Aero Engine Corp of China displayed a rotating, full-size model of the CJ1000 engine under development for the C919 narrowbody plane, which could eventually replace the imported CFM International LEAP-1C engines.

The C919 has found it harder to meet certification and production targets thanks to tough U.S. export rules, Reuters reported on Monday, citing sources with knowledge of the situation.

"With an unrivalled domestic market and increasingly participation of private investment, it is only a matter of time for China to resolve external tech blockages," Wang Yanan, chief editor of Beijing-based Aerospace Knowledge magazine, told the Global Times in response to the Reuters story.

Western planemakers are also finding it increasingly difficult to gain certification for new models that would compete against Chinese-made planes.

The Airbus (AIR.PA) A220, Embraer (EMBR3.SA) E-Jet E2 series and ATR 42-600 turboprop have not yet been approved by China's aviation regulator despite being in service elsewhere for years, hindering the chances of local sales.

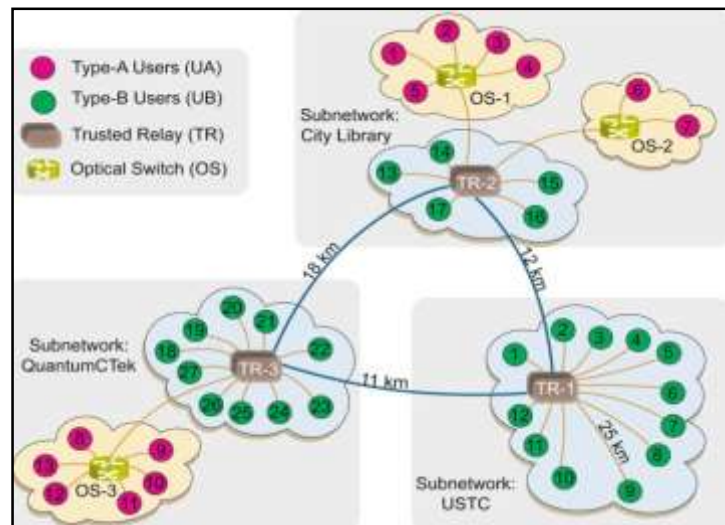
Boeing (BA.N), however, said at the show it remained hopeful the 737 MAX would receive approvals for its return in China by the end of the year after being grounded for more than two years.

<https://english.jagran.com/world/new-drones-jets-electronic-warfare-fighter-and-more-china-displays-military-might-at-airshow-10032902>

## Implementing a 46-node quantum metropolitan area network

By Thamarasee Jeewandara

Quantum key distribution (QKD) is a method used for secure or secret key exchanges between two remote users. Using secure communication, cyberscientists ultimately aim to establish a global quantum network. Existing field tests suggest that such quantum networks are feasible. To achieve a practical quantum network, several challenges must be overcome including the realization of varied topologies at large scales, simple network maintenance and robustness to node failures. In a new report now published on *Science Advances*, Teng-Yun Chen and a research team in quantum physics, quantum information and interdisciplinary information sciences in China, presented a field operation of a quantum metropolitan area network with 46 nodes. They realized diverse topological structures and ran the network for 31 months via standard equipment. They then realized QKD pairing and key management for secure communications including real-time voice telephone, text messaging and file transmission with one-time pad encryption to support 11 pairs of users to make simultaneous audio calls. The technique can be combined with an intercity quantum backbone and via ground-satellite links to form a global quantum network.



The topological structure of our quantum network. The network mainly comprises three subnetworks that are directly connected to each other. In each subnetwork, there are multiple users connected to intermediate nodes in different ways, either by an all-pass optical switch (OS) or by a trusted relay (TR). Users connected by a switch are denoted as red dots (Type-A Users, UA), holding both a quantum transmitter and a receiver. Users connected to a trusted relay are denoted as green dots (Type-B Users, UB), only holding a quantum transmitter. Specifically, UA-1 to UA-5 are connected to OS-1, UA-6 and UA-7 are connected to OS-2, UA-8 to UA-13 are connected to OS-3, UB-1 to UB-12 are connected to TR-1, UB-13 to UB-17 are connected to TR-2, and UB-18 to UB-27 are connected to TR-3. Credit: Nature Quantum Information, 10.1038/s41534-021-00474-3

### Global quantum network

In this work, Chen et al. constructed a 46-node quantum metropolitan-area network throughout the city of Hefei. Quantum key distribution (QKD) ultimately aims to construct a global quantum network where communication traffics have information-theoretic security guarantees. A global QKD network can maintain two types of links including the ground network and satellite network, where the ground network can be further divided into a backbone, metropolitan and access networks to cover intercity distance and fiber-to-home distances. Researchers have studied the feasibility of the QKD between two users through long-distance free space, telecom fibers and simulated ground-satellite links. Examples of the field tests of QKD networks that are already realized include a three-user network by DARPA, a six-node network in Europe, the

SwissQuantum network as well as a mesh-type six-node network in Tokyo. The satellite network provided a promising method to realize intercontinental, secure communication as a result of low transmission attenuation in space while serving as a trusted relay to connect remote user nodes or subnetworks. Scientists had recently implemented a large-scale satellite network containing four metropolitan-area networks, a backbone network and two satellite-ground links. However, these QKD experiments and networks are still preliminary, the team therefore addressed the challenges surrounding the realization of a large-scale practical QKD network.

### **Building a 46-node quantum metropolitan-area network**

Chen et al. built a 46-node quantum metropolitan-area network to connect 40 user nodes, three trusted relays and three optical switches, throughout Hefei. The network covered the entire urban area and connected several organizations within the city districts including governments, banks, hospitals, and research universities. They first reviewed the basic topological structures in a network where the most robust method used a fully connected topology where each user was directly connected to every other user in the network. The type of network did not require the users to trust one another. User nodes can also be connected via a central switch in a star-like network, where two users can build secure keys with a sufficient number of trusted relays. For instance, the Shanghai-Beijing backbone used this technique; however, the disadvantage is that the users must trust the relay. Chen et al. constructed three subnetworks in USTC, QuantumCTek and the City Library that are distributed 15 km apart.

### **Network topology and standard QKD equipment**

The researchers realized two basic types of topological connection structures including the full connection between three subnetworks and star-like connections for local access networks. During the experiments, the team used an optical switch known as a trusted node at the center of the star-like subnetwork. Using the trusted node, they assigned classical keys between users to function as a classical router, while the all-pass optical switches acted as quantum routers to redistribute quantum signals. Based on the setup, any two users could communicate directly without interfering with other users. Chen et al. further developed a type of switch module comprising four input and eight output ports, the other contained a 16-port switch that enabled eight pairs of users to communicate simultaneously. The team used a protocol to generate secret keys between directly connected users and trusted relays. If one user had a quantum transmitter and the other had a quantum receiver, they could generate keys. The platform therefore contained two types of users; those directly connected to a switch containing both a transmitter and receiver, and users directly connected to a trusted relay with only a quantum transmitter. As a result, the scientists used two types of equipment; one to transmit signals and another to transmit and receive signals at the same time. After basis reconciliation and error correction, they standardized the QKD equipment to greatly reduce the number of devices used.

### **Designing a switching strategy: Applications and robustness of the network**

Chen et al. developed a key management process to allow users to generate keys in high priority. To accomplish this, they designed a switching strategy based on the number of keys stored in the local memories for the users. They then connected a 16-port optical switch to 16 users to obtain a total of 120 possible key-pairing schemes by which two users could be connected for the QKD process for a switching time ranging from 10 to 60 minutes. To join the network, a new user first had to send a heartbeat frame from their QKD device to the key management server for authentication to then queue the device to generate keys. For security, the team followed the standard decoy-state BB84 security analysis and generated the secret key rate of the BB84 quantum key distribution protocol. Based on the application of the network, the users made use of the generated secure keys to transfer information confidentially. Using the network, Chen et al. transmitted encrypted information, including real-time voice telephone, instant messaging, and digital files with the one-time pad encryption method. The total delay in the encryption process was less than 50  $\mu$ s. When the researchers tested the capacity of the network for 50 minutes, all 22 users could simultaneously make calls for six minutes, within the quantum network. To test the stability and robustness of the system, they continuously ran the network for 31 months.

## Outlook

In this way, Teng-Yun Chen and colleagues developed a practical and large-scale metropolitan quantum key distribution (QKD) network with commercial QKD products for practical use in Hefei, China. The team could scale the quantum network by adding more users and relays to connect to the Shanghai-Beijing backbone as a national network. The network can also be combined with other QKD protocols to overcome imperfections of measurement devices for efficient and secure communication.

**More information:** Teng-Yun Chen et al, Implementation of a 46-node quantum metropolitan area network, *npj Quantum Information* (2021). DOI: [10.1038/s41534-021-00474-3](https://doi.org/10.1038/s41534-021-00474-3)

Sebastian Nauerth et al, Air-to-ground quantum communication, *Nature Photonics* (2013). DOI: [10.1038/nphoton.2013.46](https://doi.org/10.1038/nphoton.2013.46)

**Journal information:** [Science Advances](#) , [Nature Photonics](#)  
<https://phys.org/news/2021-09-node-quantum-metropolitan-area-network.html>



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# Unusual material could improve the reliability of electronics and other devices

By Louise Lerner

Moving heat around where you want it to go—adding it to houses and hairdryers, removing it from car engines and refrigerators—is one of the great challenges of engineering.

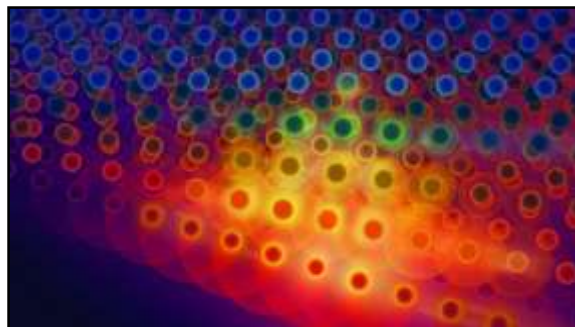
All activity generates heat, because energy escapes from everything we do. But too much can wear out batteries and electronic components—like parts in an aging laptop that runs too hot to actually sit on your lap. If you can't get rid of heat, you've got a problem.

Scientists at the University of Chicago have invented a new way to funnel heat around at the microscopic level: a thermal insulator made using an innovative technique. They stack ultra-thin layers of crystalline sheets on top of each other, but rotate each layer slightly, creating a material with atoms that are aligned in one direction but not in the other.

"Think of a partly-finished Rubik's cube, with layers all rotated in random directions," said Shi En Kim, a graduate student with the Pritzker School of Molecular Engineering who is the first author of the study. "What that means is that within each layer of the crystal, we still have an ordered lattice of atoms, but if you move to the neighboring layer, you have no idea where the next atoms will be relative to the previous layer—the atoms are completely messy along this direction."

The result is a material that is extremely good at both containing heat and moving it, albeit in different directions—an unusual ability at the microscale, and one that could have very useful applications in electronics and other technology.

"The combination of excellent heat conductivity in one direction and excellent insulation in the other direction does not exist at all in nature," said study lead author Jiwoong Park, professor of chemistry and molecular engineering at the University of Chicago. "We hope this could open up an entirely new direction for making novel materials."



Random twists between layers of crystalline sheets block heat going through the layers, but still maintain good heat flow along the sheets. Researchers measure an astonishing factor of 900 in the difference in heat flow. Credit: Neuroncollective.com, Daniel Spacek, Pavel Jirak / Chalmers University

Scientists are constantly on the search for materials with unusual properties, because they can unlock completely new capabilities for devices such as electronics, sensors, medical technology or solar cells. For example, MRI machines were made possible by the discovery of a strange material that can perfectly conduct electricity.

Park's group had been investigating ways to make extremely thin layers of materials, which are just a few atoms thick. Normally, the materials used for devices are made up of extremely regular, repeating lattices of atoms, which makes it very easy for electricity (and heat) to move through the material. But the scientists wondered what would happen if they instead rotated each successive layer slightly as they stacked them.

They measured the results and found that a microscopic wall made of this material was extremely good at preventing heat from moving between compartments. "The thermal conductivity is just amazingly low—as low as air, which is still one of the best insulators we know," said Park. "That in itself is surprising, because it's very unusual to find that property in a material that is a dense solid—those tend to be good heat conductors."

But the point that was really exciting for the scientists was when they measured the material's ability to transport heat along the wall, and found it could do so very easily.

Those two properties in combination could be very useful. For example, making computer chips smaller and smaller results in more and more power running through a small space, creating an environment with a high "power density"—a dangerous hotspot, said Kim.

"You're basically baking your electronic devices at power levels as if you are putting them in a microwave oven," she said. "One of the biggest challenges in electronics is to take care of heat at that scale, because some components of electronics are very unstable at high temperatures.

"But if we can use a material that can both conduct heat and insulate heat at the same time in different directions, we can siphon heat away from the heat source—such as the battery—while avoiding the more fragile parts of the device."

That capability could open doors to experiment with materials that have been too heat-sensitive for engineers to use in electronics. In addition, creating an extreme thermal gradient—where something is very hot on one side and cool on the other—is difficult to do, particularly at such small scales, but could have many applications in technology.

"If you think of what the windowpane did for us—being able to keep the outside and inside temperatures separate—you can get a sense of how useful this could be," Park said.

The scientists only tested their layering technique in one material, called molybdenum disulfide, but think this mechanism should be general across many others. "I hope this opens up a whole new direction for making exotic thermal conductors," Kim said.

**More information:** Shi En Kim et al, Extremely anisotropic van der Waals thermal conductors, *Nature* (2021). DOI: [10.1038/s41586-021-03867-8](https://doi.org/10.1038/s41586-021-03867-8)

**Journal information:** *Nature*  
<https://phys.org/news/2021-09-unusual-material-reliability-electronics-devices.html>

# Study unveils the quantum nature of the interaction between photons and free electrons

By Ingrid Fadelli

For several decades, physicists have known that light can be described simultaneously as a wave and a particle. This fascinating 'duality' of light is due to the classical and quantum nature of electromagnetic excitations, the processes through which electromagnetic fields are produced.

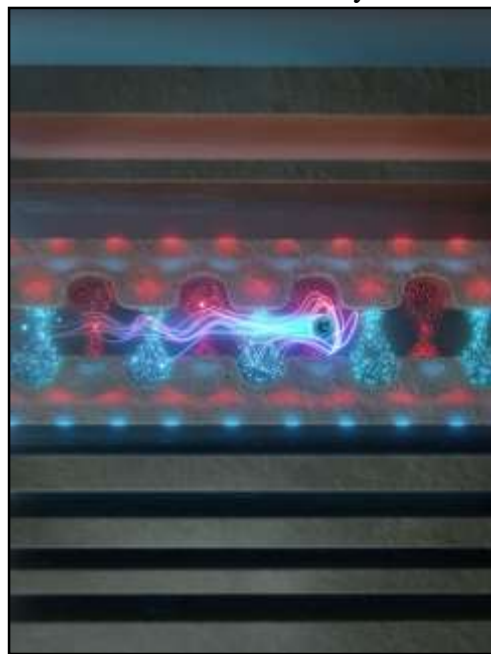
So far, in all experiments in which light interacts with free electrons, it has been described as a wave. Researchers at Technion—Israel Institute of Technology, however, have recently gathered the first experimental evidence revealing the quantum nature of the interaction between photons and free electrons. Their findings, published in *Science*, could have important implications for future research investigating photons and their interaction with free electrons.

"The idea for our study first came to us around two years ago, after our experimental discovery that the interaction between a free electron and light can maintain its coherence over distances of a hundred times the optical period," Raphael Dahan, Alexey Gorlach and Ido Kaminer, three of the researchers who conducted the study, told Phys.org via email. "Around this time, two important theoretical works also came out, both of which explored how the quantum properties of light should change the interaction with electrons."

These two previous theoretical studies, one by Ofer Kfir at University of Göttingen and the other by Javier García de Abajo and his colleagues at Institut de Ciències Fotòniques (ICFO), predicted a new type of fundamental interaction that occurs between light and free electrons, revealing the quantum properties of light. Drawing inspiration from these important predictions, Kaminer, Dahan, Gorlach and their colleagues started searching for a system in which they would be able to investigate this interaction experimentally. More specifically, the researchers wanted to demonstrate that the quantum statistics of light can alter the electron–light interaction.

"This led us to look for two important components," Kaminer, Dahan and Gorlach explained. "The first is a device that will have better coupling between the electron and the light, and the second is a photonic source that will generate quantum light with the highest possible intensity."

To achieve a greater coupling efficiency, the researchers consulted with members of the accelerator on-chip (ACHIP) research community, which aims to achieve compact electron acceleration using lasers and integrate it on-chip. After a series of calculations, the team found that the coupling efficiency can be enhanced in hundred times compared to what was suggested by all previous experiments.



An artist's depiction of the ACHIP structure and the interaction in it. A silicon-photonics device integrated in an electron microscope provides efficient electron interactions with CW light, enabling the detection of the quantum photon statistics. Depending on the photon statistics of light, the electron becomes entangled with the light when passing through a silicon-photonics channel. The image uses the exact design of the silicon-photonics accelerator, and also uses the exact field distribution inside it to depict the photonic field distribution. Credit: SimplySci Animations, Urs Haeusler, and the AdQuanta group at the Technion.

"We first collaborated with a group from Stanford (Solgaard, England, Leedle, Byer, and their students) – they designed and provided us with an ACHIP structure for the first test," Kaminer, Dahan and Gorlach said. "This became the first experiment using a silicon-photonics chip inside a transmission electron microscope, and already had fascinating implications, resulting in another paper which will soon appear in PRX, by Yuval Adiv et al."

Subsequently, Kaminer and his colleagues initiated a collaboration with another part of the ACHIP community, a team led by Peter Hommelhoff at Erlangen Germany. This research group provided the best-in-the-world ACHIP structures necessary for Kaminer to conduct this complicated experiment.

To generate intense quantum light, the researchers worked closely with the Eisenstein group at Technion. This group allowed them to use a special kind of optical amplifier: an instrument that can change the quantum photon statistics of light from a Poissonian distribution (as in classical coherent light) to a super-Poissonian distribution.

"Our study was quite a journey," Dahan said. "Combining all these different elements and through a very challenging experiment using our ultrafast transmission electron microscope, we achieved our primary objective: demonstrating the first interaction between a free electron and light with different quantum properties."

Kaminer and his colleagues were ultimately able to unveil the quantum nature of the interaction between photons and free electrons by continuously changing the photon statistics throughout their experiment and showing how the electron energy spectrum changes in response. The change in the photon statistics they observed varied depending on the intensity of the pump and laser seed in the optical amplifier.

The primary interaction the researchers explored is the one involving the input light and free electrons. In their experiments, electrons act as the detectors of the state of light. Thus, by measuring their energy, the researchers were able to extract quantum information about light.

The electron measurements can only be explained by quantizing both the electron and the light, as predicted by the theoretical papers they drew inspiration from. "Only once using this new theory, the agreement with our measurements became very good," Kaminer said. "From a fundamental perspective, the main findings of our study are: the interaction between quantum light and a free electron, the emergence of entanglement in the interaction and the quantum-classical correspondence principle. This principle shows the effect of a quantum walk by the electron and its transition into a random walk."

In addition to potentially paving the way for new light-related physics research, the experimental evidence could inform the development of several new technologies. This includes non-destructive and non-invasive imaging tools that can collect high-resolution images.

"Firstly, we showed that one can use free electrons to measure the quantum photon statistics of light," Kaminer, Dahan and Gorlach said. "There are several advantages of such measurements that could be demonstrated in the future, for example, being non-destructive, having high temporal resolution, and happening in the nearfield with high spatial resolution."

The recent work by Kaminer and his team proves that it is possible to temporarily shape electrons using continuous wave (CW) light. This result could enable the integration of silicon-photonics chips into electron microscopes to enhance the capabilities of electron microscopy, for instance, to introduce attosecond time resolution into state-of-the-art microscopes without harming their spatial resolution.

"We now plan to continue our work in two main research directions," Kaminer, Dahan and Gorlach said. "The first is working toward full quantum state tomography of photonic nearfields, like measuring squeezing of light on-chip with no need to out-couple the light. Another direction that we are looking into is creating quantum light using coherently-shaped electrons, following the vision we laid out in our recent theory paper that suggested this direction."

**More information:** Raphael Dahan et al, Imprinting the quantum statistics of photons on free electrons, *Science* (2021). [DOI: 10.1126/science.abj7128](https://doi.org/10.1126/science.abj7128)



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**Journal information:** *Science* , *Physical Review Letters*  
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## COVID-19 Research News

The Indian EXPRESS

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# Can vitamin A nasal drops help restore Covid loss of smell? Know what experts say

*While vitamin A drops are available in India, Dr Shuchin Bajaj said the "wait is on for the final result of the research to make use of it in our patients"*

New Delhi: A new medical trial in the UK is researching whether vitamin A nasal drops can be given to Covid patients to recover their loss of smell, a common symptom of the infection, which is sometimes even experienced by post-Covid patients. The 12-week trial by University of East Anglia (UEA) aims to compare a group of volunteers receiving vitamin A nasal drops with those receiving a placebo of inactive drops.

It is considered that the complaints of loss of smell and taste can last much longer than the virus itself, staying in place even when patients are testing negatively.

As per the research team's press statement, previous research from Germany has "shown the potential benefit" of vitamin A in treating smell loss, and the trial is designed to "explore how this treatment works to help repair tissues in the nose damaged by viruses".

The volunteers will be made to smell odours like rotten eggs and roses for "special brain scans" to gauge whether smelling can repair and detect brain activity, said UEA medical professor Carl Philpott.

Vitamin A, or retinol, experts say, has a range of benefits including for the skin, bone health, and even improving vision. A February 1962 *JAMA* network study also mentioned how vitamin A can help restore olfactory sense.

Vitamin A plays a vital role in metabolism and plays a vital role in regulating immune responses and reducing susceptibility to infections, said Sakina Diwan, dietician, Bhatia Hospital. "The mechanism adopted by vitamin A to reduce infection is often through modifying epithelial cell integrity and function," she said.

Common sources of vitamin A include cheese, eggs, oily fish, milk, yoghurt, and liver products. "Your body will also convert beta-carotene into vitamin A when consumed. Sources of beta-carotene include yellow, red, and green leafy vegetables, such as spinach, carrots, sweet potatoes, and red peppers, and yellow fruit, like mango, papaya, and apricots," mentioned Diwan.

As per Harvard Medical School, temporary loss of smell, or anosmia, is the main neurological symptom and one of the earliest and most commonly reported indicators of Covid. Notably, it is considered a better indicator of the infection than common symptoms like fever and cough. But the underlying mechanisms for loss of smell in patients with Covid-19 have been unclear.

According to experts, vitamin therapies have been used to cure many diseases for quite some time. Many physicians are now recognising the beneficial uses of antioxidants and other vitamins

for a wide variety of conditions, often as a complementary therapy to accompany medication or other treatments, they say.

“When it comes to vitamin A, we have been using it to reduce complications of diseases such as malaria, HIV/AIDS, and measles, and for fertility, diarrhea, vision, child development, skin disorders, infections, and any other condition,” explained Dr Shuchin Bajaj, founder-director, Ujala Cygnus Group of Hospitals.

While vitamin A drops are available in India, Dr Bajaj said the “wait is on for the final result of the research to make use of it in our patients”.

However, Dr Manoj Sharma, senior consultant, internal medicine, Fortis Hospital, Vasant Kunj, New Delhi said the view that a few drops of vitamin A can fix the activity of damaged smell pathways in the brains of patients is not correct and has not been corroborated yet.

“In all honesty, I would not like to comment on the same as I do not think it will prove to be effective or helpful for patients with Covid. I think the only thing that can help are precautionary measures,” said Dr Sharma.

<https://indianexpress.com/article/lifestyle/health/vitamin-a-nasal-drops-covid-loss-of-smell-study-trial-benefits-7543955/>

